

CALIFORNIA'S **CLEAN ENERGY FUTURE**



AN OVERVIEW ON MEETING CALIFORNIA'S ENERGY AND ENVIRONMENTAL GOALS IN THE ELECTRIC POWER SECTOR IN 2020 AND BEYOND



Under Governor Schwarzenegger's leadership,

California has adopted ambitious environmental and energy policy goals, including reducing statewide greenhouse gas (GHG) emissions to 1990 levels by 2020 and to 20 percent of 1990 levels by 2050, and providing 33 percent of our electricity demand in 2020 from renewable resources. The Governor's Executive Orders establishing greenhouse gas reductions and renewable energy goals provide a strong foundation for the development of clean energy technologies and environmental benefits. California's energy sector will need to meet these goals while facing multiple challenges, including addressing once through cooling requirements and limitations on air emissions credits. The State's energy and environmental agencies must also work together closely to achieve these ambitious policy objectives on the timeframes established by State legislation and regulation. In meeting these near- and longer-term policy goals, the State must also continue to ensure that its residents are provided with safe, reliable electricity at just and reasonable rates. Immediate attention and creative solutions are required.

The California Environmental Protection Agency (CalEPA), California Air Resources Board (CARB), California Energy Commission (Energy Commission), California Public Utilities Commission (CPUC), and the California Independent System Operator (California ISO), recognize they cannot reach the Governor's clean-energy goals for California without identifying their policy interdependencies and improving their communications and cooperation. This overview of California's Clean Energy Future for the power sector in 2020 and beyond is the first of a series of documents jointly developed by these agencies in support of the State's policy goals.

This document describes the key elements on which the state is relying to achieve its 2020 electricity and natural gas policy goals (including both the reduction measures themselves and the "enabling technologies" needed to deploy them). It is intended to guide state agency activities by providing a set of clear and quantifiable goals that will guide operational, technological and infrastructure needs analysis; program design, long-term planning and procurement functions; research and development activities; and further reforms of the wholesale power markets. Achieving California's goals depends on state leaders engaging California citizens, customers, businesses, and stakeholders including non-governmental organizations and local governments.

The foundations for this document are California's Loading Order policy, first adopted by the energy agencies in the *2003 Energy Action Plan*, the energy-sector measures articulated in CARB's Assembly Bill (AB) 32 Scoping Plan, and additional measures and enabling strategies identified by the energy agencies.

***California's
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Energy efficiency and demand response are the highest-ranking resources in the Loading Order and remain California's top priority for meeting our future energy needs. Renewable energy is California's supply-side resource of choice, followed by combined heat and power (CHP) and distributed generation (DG) as well as the cleanest and most-efficient conventional generation. One of the goals set out in Governor Schwarzenegger's Executive Order S-06-06 is to meet 20 percent of the state's renewable energy targets with biomass and biogas. Work to achieve this goal for the electricity sector is coordinated with actions to advance the use of biofuel in the transportation fuels sector through the *Bioenergy Action Plan*.

Developing and implementing the array of strategies identified to meet both the overarching goals and the specific targets contained in this document is extremely challenging and will necessitate overcoming numerous structural, technological, and economic obstacles. There is a great deal of uncertainty about which particular generation and transmission resources will be developed. This uncertainty is intensified by the addition of DG and CHP resources, since they involve consumer choices over which electricity system planners have little control. On the other hand, success in achieving some goals may lower obstacles and/or lessen the need to fully implement others to reach the targeted GHG reductions. In addition, the substantial amount of American Recovery and Reinvestment Act (ARRA) funding nationally in areas such as energy efficiency, smart grid, electric vehicle technologies, renewables, and advanced technology demonstrations may boost energy sector technologies to accelerate new and emerging energy efficiency, automated demand response, electric vehicle/plug-in hybrid vehicles, and other technologies. Governor Schwarzenegger and his agencies are providing a supportive policy environment and appropriate incentives to make California a leader in these emerging technology sectors.

The task at hand will require more than summing up individual actions. State agencies must maintain a broad perspective on which policies are pursued to recognize their interactions and avoid unpleasant surprises or missed opportunities. Everything will not go as expected, and adaptive management practices must be employed to identify policy overlaps, conflicts, unanticipated or unintended consequences, and vulnerabilities in time to make necessary trade-offs and course corrections.

To further address these uncertainties, the joint agencies plan to review and revise our recommended strategies and specific targets on a biennial basis following each demand forecast update provided by the Energy Commission in its *Integrated Energy Policy Report*. The agencies will need to better coordinate planning efforts and make any needed course corrections in response to lessons

learned and market developments. Close tracking of progress on the goals combined with continued attention to contingency planning, will be critical to maintaining system reliability.

Energy Demand

The transformation of California's building infrastructure will be well underway by 2020. Strategies for realizing 100 percent of achievable cost-effective energy efficiency will include progressively more stringent building and appliance standards, incentive programs, innovative financing mechanisms, targeted research, development and demonstration efforts, new business models, technical assistance, targeted marketing, education and outreach. Statewide implementation of smart grid technologies, as well as electric rate design reform, will provide additional opportunities for customers to install behind the meter resources and utility-level enabling technologies in response to a price signal or usage information.

Key programs and strategies will be developed to ensure that a significant portion of new residential and commercial buildings in California are zero net energy and existing residential and commercial buildings have decreased energy consumption by 30 percent to 70 percent from 2008 levels.

A diverse array of new partners will be actively engaged in designing and delivering energy efficiency products to Californians. Public, private and non-profit sector entities will all participate in a vibrant energy-efficiency marketplace. New players will have incentives to provide innovative services in critically important areas such as financing, marketing, and efficiency measures. Strategic planning for energy efficiency will look well beyond traditional utility efficiency programs and incorporate the ideas and resources of other market actors.

Building labeling and certification programs, combined with centralized technical and public policy guidance and enhanced workforce training will encourage and enable continuous improvement in energy efficiency. Increased energy efficiency and greater use of combined heat and power will be pursued as part of an integrated approach that will also include demand response, energy storage, distributed generation and renewable energy.

Additional savings will be realized as a result of water use efficiency improvements; reuse of urban water runoff; water recycling; water system energy efficiency; renewable energy production from the water sector; and the design and implementation of a public goods charge to fund water

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conservation and future combined water use efficiency and energy efficiency projects.

Based on the measures described above, we are targeting additional reductions of 5,000 to 8,100 megawatts (peak demand) and 800 million therms of natural gas consumption by 2020, in addition to the 2,300 megawatts (peak demand) of committed energy efficiency savings already included in the 2009 demand forecast.

Demand response will play a major role in meeting peak power needs. Price-driven demand response will be eligible to participate in the wholesale market, including ancillary service markets needed to support renewable integration. The implementation of emerging technologies like automated demand response will provide increased capability to augment the amount of demand response from all customers. Price-driven demand response will continue to grow and become an increasingly larger resource in the wholesale market, and reliability-triggered demand response will continue to be available to respond to system-wide and local peak events.

Distributed generation technologies will be deployed at significantly higher levels, both behind-the-meter and as wholesale power. Governor Schwarzenegger's Go Solar California (made up of the California Solar Initiative and the New Solar Homes Partnership) and Small Generator Incentive Programs will make significant progress towards removing barriers to behind-the-meter DG, including installed cost, installer infrastructure, availability of financing products, and consumer acceptance.

Feed-in-tariffs and other procurement strategies will be expanded to address impediments to wholesale DG and CHP, including transaction costs, developer experience, financing, interconnection processes, local permitting, and operational impacts on the distribution system. Biomass electricity generation using in-state waste streams will be a major component of base-load power in the state.

By 2020, the agencies are targeting 5,000 megawatts of installed renewable DG statewide at the right locations on the power grid to support reliability and provide economic value.

Energy Supply

California will develop a mix of renewable resources sufficient to meet Governor Schwarzenegger's 33 percent renewables target while maintaining operational and reliability needs over time. The mix of renewable resources in 2020 and beyond, along with the conventional generation and other resources providing integration capabilities, will be optimized through electricity system planning. This includes estimates of system operational requirements, resource adequacy requirements, forward procurement planning and wholesale market price signals that provide the right incentives for operability and encourage minimization of integration requirements.

To ensure operational reliability, avoid excess GHG emissions, and reduce overall system costs, by 2020 the Agencies are targeting a significant fraction of renewable supply resources to have dispatch capabilities, such as the capability to decrease (and possibly increase) their output of energy in response to either dispatch instructions or automated control signals.

Natural gas generation resources will continue to be essential to meet California's demand for energy, and procurement and resource adequacy programs will deliver resources needed for system and local reliability requirements and system operational needs. The existing thermal fleet will be modified as needed to support renewable integration, with increased operational flexibility, ramping capability and regulation services; lower operating limits; and more frequent start/stop operation. This will allow substantial amounts of intermittent renewable generation to be integrated with the least possible amount of GHG emissions from the thermal fleet. State agencies and the ISO will develop the appropriate procurement and market rules to provide the revenues needed to achieve these characteristics, including any additional operating and maintenance costs.

Consistent with existing and future policies adopted by the State Water Resources Control Board, California will retire, repower, replace, and/or mitigate once-through cooling thermal power plants to improve coastal and estuarine environmental quality. The older plants are typically located in transmission-constrained areas that required local generation. With transmission upgrades, some of the replacement capacity may be remotely located to enable reliance on renewable resources. In cases where facilities are replaced by thermal power plants, the new (or repowered) facilities will reduce greenhouse gas emissions by being more efficient than those they replace.

California will be an active participant in the research, development, and deployment of carbon capture and storage technologies.

California will replace approximately 28,000 gigawatt-hours of coal-fired generation owned by or under long-term contract to the state's electric utilities through 2030. Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006) and implementing regulations by the Energy Commission and CPUC will result in a substantial displacement of coal-based imports into California from long-term commitments (ownership shares and contracts) entered into before AB 32 was enacted. Such coal imports will be backed out of the State's portfolio by a combination of reduced demand, cleaner imports, and cleaner facilities located in California.

At Governor Schwarzenegger's direction, California is an active participant in the research, development, and deployment of carbon capture and storage (CCS) technologies, which provide the capability for separating CO₂ from process and exhaust gases at large industrial plants, including power plants, and then storing the captured CO₂ in secure geologic formations.

Agencies will coordinate their efforts to ensure that by 2020, the regulatory framework is in place to address the permitting and operating of CCS facilities by making regulatory recommendations, providing statewide public outreach activities, and addressing public concerns about the implementation of CCS technologies in California. The agencies are targeting the development of at least one utility-scale CCS generating facility in California by 2020.

Transmission, Distribution, and Operations

Planning and permitting will be coordinated to ensure that California's transmission development is no longer a barrier to achieving environmental goals. Sufficient high-voltage transmission and distribution-level infrastructure will be available to achieve renewable goals and GHG emissions reductions. Governor Schwarzenegger appointed the State's first senior advisor tasked with addressing the critical link between transmission and generation planning and permitting so to ensure that needed projects are planned for, corridors are set aside as necessary, and permits are obtained in a timely and effective manner that maximizes existing infrastructure and rights-of-way, minimizes land use and environmental impacts, and considers technological advances.

Through advanced transmission technologies (including advanced storage technologies), improved dispatch algorithms, enhanced system visibility and access to real-time data, and efficient generation and transmission infrastructure planning decisions,

California will increase the utilization of the grid in support of policy goals and cost-minimization. California will also upgrade its distribution system to assure reliability and support the cost-effective integration and interoperability of large amounts of distributed energy.

Investments in advanced metering and smart grid technology will empower customers to use energy more efficiently, and increase price-responsiveness of demand. All commercial and industrial customers will be enrolled by default into dynamic pricing programs that reflect wholesale costs and provide meaningful price signals. Rates for customers who opt-out of dynamic pricing will reflect the insurance value of avoiding market exposure. Inexpensive hardware and software will enable integration of advanced meters that provide all customers (residential, commercial and industrial) the real time information necessary to better understand their individual energy needs and use patterns so they can reduce their bills and manage their energy use in response to price and system conditions.

Energy storage will be a significant feature of the cleaner power system. As a result of agency support for storage technology pilot studies, increased utility-scale and aggregated smaller scale storage technologies (such as batteries, flywheels, compressed air energy storage, pumped, hydroelectric energy storage, and capacitors) will be available to help facilitate integration of intermittent wind and solar renewable resources; shift renewable production to times of higher value and demand; and provide grid operators with ancillary services such as regulation and spinning reserve.

The agencies are targeting 1,000 megawatts of additional storage capacity to be brought onto the system by 2020.

Additional Supporting Processes

The electricity sector will be subject to a state, regional, and/or federal GHG cap-and-trade system to ensure minimum cost of emissions abatement. While it is likely that the measures identified in this document will be needed to achieve the state's longer-term emission reduction goals regardless of reductions achieved in other carbon-emitting sectors of the economy, it is possible that technological breakthroughs in other sectors could provide more cost-effective reduction opportunities to society as a whole in the 2020 timeframe.

Cap and trade mechanisms provide opportunities for lower cost reductions in GHG emissions and the displacement of higher cost efforts. Beginning in 2012, a GHG emission allowance market will

serve as an additional economic signal to decisions on short-term operations and longer-term investment and planning in the electricity sector. This signal will inform the pace at which the state implements some of the costlier emission reduction measures identified in this overview to ensure that we meet the State's 2020 emission reduction goal via the most cost-effective path possible.

California will build upon its programs to accelerate innovation and commercialization of emerging technologies. Support for emerging technologies via appropriate ratepayer and public funds for research, development, demonstration, and early-stage deployment programs will result in the availability of new energy efficiency and clean energy products and enabling technologies. The Governor's Office of Economic Development will play a key role in maximizing the jobs and economic opportunities created by this sector in California.

Alternative Fuel Vehicles will become a central component of an efficient path to GHG emissions reductions and energy security. California's transportation sector will be comprised of a portfolio of low-carbon fuel and vehicle technologies including battery and fuel cell electric drive vehicles, low-carbon biofuels, increased vehicle efficiency, and natural gas and propane vehicles.

Electrification of transportation through the use of plug-in electric vehicles and fuel cell vehicles coupled with a cleaner energy supply will become a central component of an efficient path to greenhouse gas emissions reductions and energy security. Electric retail rate reform and wholesale market price signals will be used to ensure that additional electrification minimizes infrastructure cost and maximizes both integration of renewable resources and GHG emissions impact, and California will develop the infrastructure and operational capabilities necessary to absorb a targeted 1,000,000 fully electric and hybrid-electric vehicles by 2020.

California will plan for and adapt to climate change in the energy sector. Climate change is already affecting California via temperature increases, precipitation changes, wildfire intensity and frequency, and other impacts that affect energy supply and demand. California needs to plan for further climate change through adaptation strategies that reflect the loading order. Given the long-term nature of energy infrastructure decisions, California's decision makers will consider climate change when evaluating energy demand, resource availability, and the siting of transmission and generation infrastructure.

California's institutions and citizens will be engaged as partners in the State's efforts. Agency, industry and environmental expertise will be harnessed to create and implement the regulatory policy, technical analysis, and market development needed to engage the

public, better coordinate resource-planning processes across state agencies, and successfully achieve the core elements of this initiative.

Greater energy efficiency awareness and access throughout California to energy-reducing and clean-energy technologies will result in significant reductions in energy consumption and a strong demand for clean energy and energy-efficient products, homes, and services.

Meeting the Goals

To meet Governor Schwarzenegger's clean energy goals for California, the State agencies must redouble their efforts to coordinate energy planning and implementation. Key planning efforts to address uncertainties and market developments include the Energy Commission's *Integrated Energy Policy Report* and *Strategic Transmission Investment Plan*, the CPUC's Long Term Procurement Planning process, the California ISO's *Annual Transmission Plan*, and the CARB's updates to the *AB 32 Scoping Plan*.

The agencies have created an integrated *Clean Energy Future Implementation Plan* (Plan) for California that clearly identifies the key actions needed to achieve our goals. The Plan identifies interactions between existing planning efforts and any necessary enhancements to them. In addition, it determines intermediate milestones along the path to meeting the objectives outlined herein and identify key uncertainties and potential "forks in the road."

The Plan will need to be regularly evaluated and updated as we learn more and meet future challenges and opportunities. Accordingly, the agencies are developing a mechanism to track progress. Systematic tracking of progress toward meeting the Plan's milestones will enable managers and decision-makers to determine resource needs, identify and anticipate problems, refocus or redirect efforts, and adjust targets in the face of new developments. The tracking process will support communication with stakeholders and the public about progress toward realizing California's Clean Energy Future and its key elements.

Under the Governor's leadership, the five agencies have created an integrated Clean Energy Future Implementation Plan.